

Saudi Electricity Company



الشركة السعودية للكهرباء

SEC DISTRIBUTION MATERIALS SPECIFICATION

12-SDMS-01

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SPECIFICATIONS

FOR

**CABLE JOINTS, TERMINATIONS AND
ACCESSORIES UP TO 36 KV**

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1.0 SCOPE:

This SEC Distribution Materials Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, testing, inspection and performance of indoor and outdoor cable joints, termination kits, separable elbow connectors, and accessories up to 36 kV, intended to be used in the distribution system of Saudi Electricity Company (SEC) in Saudi Arabia

Cable joints and terminations shall be heat shrinkable, pre-molded or cold shrinkable type. Separable elbow connectors shall be pre-molded, dead break, fully insulated, shielded and bolted type.

2.0 CROSS REFERENCES:

This specification shall always be read in conjunction with the SEC General Specification No.01-SDMS-01 (latest revision) titled "General Requirements for all Equipments/ Materials", which shall be considered as an integral part of this SDMS. This SDMS shall also be read in conjunction with SEC Purchase Order or Contract schedules and the scope of work and technical specifications for project, as applicable.

The latest revision of the following specifications shall be applicable for reference to the cables, cable connector and cable lugs.

- | | | |
|-----|---|---|
| 2.1 | 11-SDMS-01 | Specification for 1000V Rating, XLPE insulated, unarmoured, power cables. |
| 2.2 | 11-SDMS-03 | Specification for 15 kV XLPE insulated power cables. |
| 2.3 | Reference for other cables up to 36 kV, cable connectors and cable lugs shall be as per tender/inquiry. | |

3.0 APPLICABLE CODES & STANDARDS:

The latest revision of the following codes and standards shall be applicable for the material covered in this SDMS. In case of any conflict, the manufacturer/vendor may propose material conforming to one group of industry codes and standards quoted hereunder without jeopardizing the requirements of this SDMS.

- | | | |
|-----|-----------------|--|
| 3.1 | IEC-60060-1&2 | High voltage test techniques. |
| 3.2 | IEC-60230 | Impulse tests on cables and their accessories. |
| 3.3 | IEC-60502-1.2&3 | Power cables with extruded insulation and their accessories for rated voltages from 1 KV ($U_m = 1.2$ kV) up to 30 KV ($U_m = 36$ KV). |
| 3.4 | VDE-0278 | Load cycling test. |
| 3.5 | IEEE-48 | Test procedures and requirements for high voltage alternating current cable terminations. |



- 3.6 IEEE-386-1995 Standard for separable insulated connector system for power distribution systems above 600 Volts.
- 3.7 IEEE-404 Test procedures and requirements for high voltage alternating current cable splices.
- 3.8 IEC-60466 Continuous condensation test.
- 3.9 IEC-60507 Salt fog test.
- 3.10 ASTM-E28 Test method for softening point by ring-and-bell apparatus.
- 3.11 EATS-09-11 Mechanical and physical testing for splices and terminations LV.
- 3.12 EATS-09-13 Mechanical and physical testing for splices and terminations MV.

4.0 DESIGN & CONSTRUCTION REQUIREMENTS:

4.1 General:

- 4.1.1 Joints, terminations, separable elbow connectors and accessories shall meet or exceed the performance of cable and requirements of this specification in all respect.
- 4.1.2 Manufacturer's drawings shall show the outline of the joints, terminations, separable elbow connectors and accessories together with all pertinent dimensions. Any variation in these dimensions due to manufacturing tolerances shall be indicated.

4.2 Design Criteria:

4.2.1 Cable Joints:

- a) The cable joints shall meet all requirements of IEEE-404, and shall be designed such that no insulating or semi-conducting tapes shall be required, except void filler tape and sealing mastic.
- b) The cable joints shall provide water-proofing, mechanical and electrical protection and be completely sealed from cable jacket to cable jacket.
- c) The diameter of heat shrinkable materials shall reduce to a pre-determined size upon application of heat in excess of 120°C yielding a minimum shrink ratio of 3 to 1 and a maximum longitudinal shrinkage of 5%.
- d) The recovered wall thickness of insulation tubing over the connector shall be uniform and equal to or greater than the cable insulation thickness as given in IEC-60502-1, 2&3.
- e) The adhesive shall have a softening temperature not less than 90°C, in accordance with ASTM-E28, be compatible with other components of joints and cables, and after curing shall not flow at temperatures of normal service.
- f) The cable joints shall meet all the test requirements mentioned in section 5.0.



4.2.2 Termination:

- a) Termination shall meet the criteria stated under section 4.2.1.a to 4.2.1.e, and shall be designed to provide a complete moisture seal, including the crotch area of multi-core cables and complete re-jacketing of individual cores conforming to class-I terminations as per IEEE-48.
- b) The insulation tubing shall be generally suitable for indoor and outdoor installation, ultra-violet and chemical resistant and without adhesive coatings and shall be capable of being stored without damage at temperatures up to 50°C.
- c) Creepage distance for outdoor termination shall be according to the latest revision of SEC General Specification No: 01-SDMS-01. Length of termination for indoor application shall be as per tender/inquiry.
- d) The termination system shall meet all test requirements described in section 5.0.

4.2.3 Separable Elbow Connectors:

Separable elbow connectors shall be bolted type and meet all the requirements of IEEE-386.

4.2.4 Cable End Caps:

Cable end caps shall be internally coated with an adhesive to provide environmental sealing to the cable jacket at the end of cable. There shall be two types of end caps, one for de-energized cable and the other for live cable.

4.2.5 Repair Sleeve:

The wrap-around sheath repair sleeve shall be of the heat shrink type and shall be coated with an adhesive which becomes activated on the application of heat and will form a bond with cable jacket when shrunk. Medium wall tube shall be heat shrinkable type and shall be uncoated.

4.3 Fabrication:

4.3.1 Cable Joints:

- a) Cable joints shall be supplied in complete kit form with all materials and components required to complete the installation. Connectors shall be included in the kits. The cable joints shall be suitable for cables specified in the tender/inquiry.
- b) Components shall not be adversely affected in any manner by contact with other materials normally used in the construction of cable joints and shall not increase the rate of corrosion of any metal with which they may come into contact.
- c) All components of a Joint shall perform without distress under the normal conditions, cyclic loading and fault conditions.
- d) Components supplied with adhesive coatings shall have means to prevent the coated surfaces from adhering to each other.



- e) In case of tape armored and shielded cable, all items needed for tape clamping shall also be included. Worm type rings shall be provided for such application.
- f) Re-instatement of mechanical protection for armored cables shall be in the form of galvanized steel wrap-around and not steel tubing. The steel wrap-around shall be protected with heat shrinkable tube.
- g) Transition joints shall be suitable for different types of cables specified in the tender/inquiry.

4.3.2 Termination:

- a) Terminations shall be supplied in complete kit form with all materials and components required to complete the installation including the cable lugs. Fabrication shall be the same as mentioned under section 4.3.1.a to 4.3.1.e.
- b) Outdoor pole top termination kits for 15 kV and 36 kV cables shall include galvanized steel mounting bracket with polymer insulators.
- c) Low voltage cable terminations shall be for outdoor use only. All accessories required for complete termination shall be included in the kit along with lugs, sealing tube for lugs, core and markers for phase and neutral.

4.3.3 Separable Elbow Connectors:

Separable elbow connectors shall be supplied in complete kit form with all its related accessories and shall be suitable for the equipment bushing specified in the tender/inquiry.

4.3.4 Cable End Caps:

Individual cap in proper packing shall be supplied.

4.3.5 Repair Sleeves:

Repair sleeves for low voltage cables in length of 1.5 meters complete with channels and clips in proper packing shall be supplied. Medium wall tubing for cable core protection shall be supplied in length of thirty meter in proper packing.

4.4 Marking:

- 4.4.1 All components of joints and terminations shall be clearly marked with the manufacturer's name and reference numbers. The marking shall be done before coating the adhesive onto the component.
- 4.4.2 Electrically conducting components shall be marked 'conducting' clearly and permanently.
- 4.4.3 All components shall be capable of being stored without deterioration within the temperature range of -10°C to +50°C. Components or materials, if subjected to a shelf life limitation, shall have the final date of use prominently and permanently shown on all packages.



4.4.4 Each hard box shall be printed with the following information:

- a) Joint/termination/accessories catalog number
- b) Purchase order number/tender
- c) Manufacturer's name
- d) Year of manufacture
- e) Date of expiry
- f) SEC item number

4.4.5 Each wooden box shall be fixed with an aluminum plate bearing the following information:

- a) Purchase order number/tender
- b) Manufacturer's name
- c) Year of manufacture
- d) Date of expiry
- e) Joint/termination/separable elbow/accessories catalog number
- f) Gross weight in kilograms (pounds)
- g) Position of slinging points and other relevant handling instructions.

5.0 TESTING AND INSPECTION:

All joints, terminations, separable elbow connectors and accessories shall be tested in accordance with the latest standards and as specified herein.

5.1 Routine Tests:

These tests shall be carried out in accordance with the requirements of standard to which the joints, terminations, separable elbow connectors and accessories are offered and shall be carried out at the factory.

5.2 Type Tests:

5.2.1 Electrical Tests:

The vendor shall provide certified, independent test reports with the bid for the materials offered to show that the electrical tests as per Table Nos. 1 through 5, can be met by sequence of testing as given under each Table.

**Table-1****Jointing Kit 1000 Volts**

Test No.	Test Description	Test Method	Test Values
1	AC Voltage Withstand	IEC-60060,1&2 IEC-60502,1,2&3	3.5 kV for 5 minutes in Water.
2	Impulse Voltage Withstand	IEC-60060,1&2 IEC-60230	10 Positive and 10 Negative Impulses at 8 kV.
3	Load Cycling	VDE-0278, Or Equivalent	- 63 Cycles of 5 Hrs heating, 3 Hrs cooling at Conductor temperature of 95°C. - Same as above, but with cable in 1 meter of water and over sheath of cable
4	DC Voltage Withstand	IEC-60060,1&2 IEC-60502,1,2&3	15 kV for 5 minutes.
5	Insulation Resistance	IEC-60060,1&2 IEC-60502,1,2&3	1000 Mega-Ohms.

Note: The test sequence shall be: 5, 1, 2, 5, 3, 5, 2 and 4.

Table-2**Termination Kit 1000 Volts**

Test	Test Description	Test Method	Test Values
1	AC Voltage Withstand	IEC-60060,1&2 IEC-60502,1,2&3	4 kV for 15 minutes.
2	Impulse Voltage Withstand	IEC-60060,1&2 IEC-60230	10 Positive and 10 Negative
3	Load Cycling	VDE-0278, Or Equivalent	63 Cycles of 5 Hrs heating, 3 Hrs cooling at Conductor Temperature of 95°C.
4	DC Voltage Withstand	IEC-60060,1&2 IEC-60502,1,2&3	15 kV for 5 minutes.
5	Insulation Resistance	IEC-60060,1&2 IEC-60502,1,2&3	1000 Mega-Ohms.

Note: The test sequence shall be: 5, 1, 2, 3, 5, 2, 3 and 4.

**Table-3****Jointing Kit 15 kV to 36 kV**

Test No.	Test Description	Test Methods and Values
1	AC Voltage Withstand	IEEE-404
2	Partial Discharge	IEEE-404
3	Impulse Voltage Withstand	IEEE-404
4	Short Time Current	IEEE-404
5	Cyclic Aging	IEEE-404
6	DC Voltage Withstand	IEEE-404
7	High Voltage Time	IEEE-404
8	Shielding	IEEE-404

Note: The test sequence shall be: 2, 1, 6, 3, 2, 4, 1, 2, 5, 2, 7 and 8.

Table-4**Termination Kit 15 kV to 36 kV**

Test No.	Test Description	Test Methods and Values
1	AC Voltage Withstand	IEEE-48
2	Partial Discharge	IEEE-48
3	Impulse Voltage Withstand	IEEE-48
4	Short Time Current	IEEE-404
5	Cyclic Aging	IEEE-404
6	DC Voltage Withstand	IEEE-48
7	Humidity and Condensation	IEC-60466 - Appendix "C" Test Period = 1000 Hours, for water conductivity Outdoor = 16 milli S/cm. Indoor = 800 micro S/cm.
8	Salt Fog	IEC-60507 - Section 3 For Salt Concentration at 20°C. Outdoor = 224 Kg/m ³ Indoor = 14 Kg/m ³

Note: The test sequence shall be: 2, 1, 6, 3, 2, 4, 1, 2, 5, 2, 7, 1 and 8.

**Table-5**

Separable Elbow Connectors
15 kV to 36 kV

Test No.	Test Description	Test Methods and Values
1	Corona Voltage Level	IEEE-386
2	AC Withstand Voltage	IEEE-386
3	DC Withstand Voltage	IEEE-386
4	Impulse Withstand Voltage	IEEE-386
5	Short Time Current	IEEE-386
6	Current Cycling	IEEE-386
7	Accelerated Sealing Life Test	IEEE-386
8	Cable Pullout (Tensile Strength)	IEEE-386
9	Operating Force	IEEE-386
10	Operating Eye	IEEE-386
11	Test Point Cap	IEEE-386
12	Test Point	IEEE-386
13	Shielding	IEEE-386

5.2.2 Mechanical and Physical Tests:

The vendor shall provide certified, independent test reports with the bid to show that the materials offered shall meet all the mechanical and physical testing requirements of EATS-09-11 and EATS-09-13, as applicable.

**6.0 PACKING AND SHIPPING:**

- 6.1 The joint, termination, separable elbow connectors and accessories shall be delivered ready for service.
- 6.2 Each kit of joint, termination and separable elbow connector along with appropriate installation instructions in English and Arabic languages shall be packed separately in hard board box. Maximum ten (10) such boxes shall be packed in properly palletized non-returnable wooden boxes.
- 6.3 Packing notes shall be included in each hard board box giving a description of the goods packed.
- 6.4 Packing shall be designed to protect against ingress of moisture and mechanical damage.
- 6.5 The kits shall not be packed in any organic material.

7.0 GUARANTEE:

The supplier shall guarantee the kits against all defects arising out of faulty design or workmanship or defective material for a period of two (2) years from the date of delivery.

8.0 SUBMITTALS:**8.1 Submittals Required with Tender/Inquiry:**

Two (2) copies or one set of reproducible of the following shall be supplied along with the tender. Additionally CD for complete technical specifications pertaining exactly to the items shall be submitted before purchase order is issued.

8.2 Certified Independent Test Reports:

- a) To show that the material offered meet the electrical type tests specified in Tables 1 through 4, as applicable.
- b) To show that the material offered meet the mechanical and physical type tests as per the applicable standards.

- 8.3 Full details of the proposed quality assurance procedures, sampling, routine tests and special tests.

**8.4 Drawings showing offered Material:**

8.4.1 Actual drawings showing the joints, terminations, separable elbow connectors and accessories including terminations into equipment in respect of which the independent test reports have been obtained.

Typical drawings are not acceptable.

8.4.2 Catalog for all the components used. Catalog numbers for the offered items shall be high-lighted.

8.4.3 Duly completed attached technical data schedule for each offered item.

8.4.4 Complete list of items contained in each joint, termination kit or separable elbow connector along with the price for each item of kit contents.

8.5 Submittals Required following Award of Contract:**8.5.1 Factory Test Reports:**

- a) Quality Assurance Tests.
- b) Routine and Special Tests.
- c) Manufacturing/Test Schedules.



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TECHNICAL DATA SCHEDULE:**Cable Joints and Terminations**

(Sheet 1 of 2)

SEC Inquiry No: _____ Item No: _____

SEC REF.	DESCRIPTION	SEC SPECIFIED VALUES (*)	VENDOR PROPOSED VALUES
4	DESIGN AND CONSTRUCTION REQUIREMENTS		
1	Joint, Termination or Separable Elbow Connector		
2	Type Heat Shrinkable Pre-Molded Cold Shrinkable		
3	Outdoor/Indoor (Termination only)		
4	Indoor Termination Length		
5	Separable Elbow Connector Type	Bolted type	
6	Rated Current of Elbow Connector		
7	Conductor material, size and number of cable cores		
8	Voltage Designation (kV)		
9	Manufacturer Catalog Number		
10	Class of Termination as per IEEE-48		
11	Creepage Distance (mm) (Outdoor Termination only)		
12	List of Items per Kit supplied with Bid or not?		
13	Size of Packing		
14	Submittals Required as part of Tender/Inquiry included or not?		
15	Weight of each Joint/Termination (Kg)		
16	Name of the Manufacturer		
17	Country of Origin		

* As per tender/inquiry, as applicable.



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TECHNICAL DATA SCHEDULE:

Cable Joints and Terminations
(Sheet 2 of 2)

SEC Inquiry No: _____ Item No: _____

- A) Additional technical informations or features specified by SEC.
- B) Additional supplementary data or features proposed by bidder/vendor/supplier.
- C) Other particulars to be filled-up by the bidder/vendor/supplier.
- D) List of deviations and clauses to which exception is taken by the bidder/ vendor/ supplier.
(Use separate sheet, if necessary).

Description	Manufacturer of Material	Vendor/ Supplier
Name of Company		
Location and Office Address		
Name & Signature of Authorized Representative with date		
Official Seal / Stamp		